REPORT DOCUMENTATION PAGE

Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project (0704-0188), Washington, DC 20503.

1. AGENCY USE ONLY (Leave blank)	2. REPORT DATE	3. REPORT TYPE AND DATES COVERED
	1 April 1996	Final Fiscal, 1 Mar 1995 - 29 Feb 1996

4. TITLE AND SUBTITLE

Feature Extraction by Best-Basis and Wavelet Methods

5. FUNDING NUMBERS

6. AUTHOR(S)

M. Victor Wickerhauser
Guido L. Weiss

AFOSR-TR-96

0160

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)

Department of Mathematics
Washington University
St. Louis, Missouri 63130

8. PERFORMING ORGANIZATION REPORT NUMBER

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)

Air Force Office of Scientific Research
110 Duncan Avenue, Suite B115
Bolling AFB, DC 20332

10. SPONSORING/MONITORING AGENCY REPORT NUMBER

F49620-92-J-0106

11. SUPPLEMENTARY NOTES

12a. DISTRIBUTION/AVAILABILITY STATEMENT

Distribution Unlimited

12b. DISTRIBUTION CODE

19960502 030

13. ABSTRACT (Maximum 200 words)

In the past year the AFOSR, through its award number F49620-92-J-0106, has directly supported the research of Professors Wickerhauser and Weiss, as well as the work of temporary visitors, graduate students and postdoctoral researchers. In the third year of the original 3-year research plan, work has been completed on all proposed projects and have expanded work on some new projects that were not envisioned. During the period from 1 March 1995 to 29 February 1996, principal investigators Weiss and Wickerhauser wrote more than a dozen articles and books on harmonic and wavelet analysis and applications. The main focus was those properties of wavelets which need to be known before implementing feature detection algorithms, such as their time and frequency localization properties and their algebraic characterizations. This AFOSR contract permitted wider dissemination of these fundamental results. It supported two visiting consultants who lectured at Washington University, and allowed Weiss and Wickerhauser to attend and lecture at 8 scientific meetings in 5 cities. It also bought one additional fast workstation on which some numerical experiments were performed and which serves the research group in wavelet analysis at the Washington University mathematics department.

14. SUBJECT TERMS

data compression, wavelets, wavelet packets

15. NUMBER OF PAGES

4

16. PRICE CODE

17. SECURITY CLASSIFICATION OF REPORT	18. SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSIFICATION OF ABSTRACT	20. LIMITATION OF ABSTRACT
UNCLASSIFIED	UNCLASSIFIED	UNCLASSIFIED	UL

AFOSR F49620-92-J-0106
Feature Extraction by
Best-Basis and Wavelet Methods:
Final Fiscal Report

M. Victor Wickerhauser and Guido L. Weiss

Department of Mathematics, Campus Box 1146
Washington University, One Brookings Drive, St. Louis, MO 63130

1 April 1996

1 Introduction

In the past year the AFOSR, through its award number F49620-92-J-0106, has directly supported the research of Professors Wickerhauser and Weiss, as well as the work of temporary visitors, graduate students and postdoctoral researchers.

In this third year of the original 3-year research plan, we have completed work on all proposed projects and have expanded work on some new projects that were not envisioned.

The budget was spent as described and itemized in the "Expenditures for AFOSR Grant" page attached at the end of this report. Individual items are explained below.

2 Domestic Travel

- **Wickerhauser:**

  New Haven, 3/95: consultation with R. R. Coifman on wavelet packet algorithms for feature detection and de-noising.

  Chicago, 3/95: presentation of a lecture at Argonne National Laboratory on wavelet methods in picture compression. on fast orthogonal transform implementations.

  Montreal, 9/95: presentation of a lecture on denoising and medical image feature detection at the IEEE Engineering in Medicine and Biology spessial session.

  Chicago, 10/95: consultation with R. R. Coifman and B. Torresani on fast orthogonal transform implementations.

  Chicago, 2/96: attend the Conference in Honor of Alberto Calderón on new methods in Harmonic Analysis.

  San Diego, 2/96: present a lecture at the NRaD conference on robust methods in picture compression for noisy channels.

- **Weiss:**

  Orlando, 1/96: attend the AMS annual meeting and special sessions on Harmonic Analysis.

  Chicago, 2/96: attend the Conference in Honor of Alberto Calderón on new methods in Harmonic Analysis.

3   Consultants

1. **Naoki Saito**, from Schlumberger–Doll Research in Connecticut, lectured on best local discriminant bases for feature detection, the subject of his PhD dissertation and subsequent articles.

2. **Chun Li**, from Macquarie University in Australia, lectured in the Wavelet Seminar at Washington University.

4   Computer Equipment

Changes in computer hardware between the proposal and the award necessitated a change of vendor and system, which was approved in writing by the program director. Instead of the proposed SUN workstation, a more cost-efficient DEC AlphaStation "zagi.wustl.edu" was purchased which had more speed, memory, and storage.

To make the DEC computer inter-operable with existing SUN ("lado") and SGI ("uhura") hardware, which had been purchased earlier partly with AFOSR funds, the software licenses for those machines were updated for $489 and $580, respectively.

EXPENDITURES FOR AFOSR GRANT
PRINCIPAL INVESTIGATORS: Wickerhauser & Weiss
WASH. UNIV. FUND NO.: 59113 & 591130
AGENCY: NSF AGENCY NO.: F49620-95-1-0231

Total award: $59,990
Dates: 1 Mar 95 - 29 Feb 96

BUDGET /OBJ. NO.	DESCRIPTION	Regular 59113	Off-Campus 591130	Total
ACADEMIC SAL.	Weiss (July '95)	12,000.00	N/A	0.00
	Wickerhauser (July Off-Campus)	6,488.89	6,488.89	0.00
TOTAL SALARIES:		18,488.89	6,488.89	24,977.78
FRINGE BENEFITS				
ANNUITY	Weiss (11.5%)	1,380.00	N/A	0.00
	Wickerhauser (7%)	454.22	454.22	0.00
TOTAL ANNUITY		1,834.22	454.22	2,288.44
SOCIAL SEC.	Weiss (1.45%)	174.00	N/A	0.00
	Wickerhauser (7.65%)	496.40	496.40	0.00
TOTAL SOCIAL SECURITY		670.40	496.40	1,166.80
HEALTH ALLNC	Weiss	209.00	N/A	0.00
	Wickerhauser	160.90	160.90	0.00
TOTAL HEALTH ALLOWANCE		369.90	160.90	530.80
OTHER FRINGES	Weiss	100.00	N/A	0.00
	Wickerhauser	100.00	100.00	0.00
TOTAL OTHER FRINGES		200.00	100.00	300.00
TOTAL FRINGE BENEFITS:		3,074.52	1,211.52	4,286.04
DOMESTIC TRAVEL	Wickerhauser, New Haven, 3/95	463.00		
	Wickerhauser, Chicago, 3/95	345.07		
	Wickerhauser, Montreal, 9/95	1,029.30		
	Wickerhauser, Chicago, 10/95	532.88		
	Weiss, Orlando, 1/96	581.55		
	Wickerhauser, Chicago, 2/96	327.82		
	Wickerhauser, San Diego, 2/96	509.91		
	Weiss, Chicago, 2/96	283.98		
Total Travel		4,123.51	0.00	4,123.51
CONSULTANTS	Chun Li, 3/95	100.00		
	Naoki Saito, 5/95	448.15		
TOTAL CONSULTANTS:		548.15	0.00	548.15
COMPUTER, SERVICES	Software license for SGI computer	580.00		
	Sun license for computer	489.00		
	Computer: DEC Alpha ("Zagi")	8,239.21		
Total Computer & Services		9,308.21	0.00	9,308.21
TOTAL DIRECT COSTS (TDC)		35,543.28	7,700.41	43,243.69
ACTUAL INDIRECT COST TAKEN (54.0% & 26.0%)		14,744.20	2,002.11	16,746.31
TOTAL DIRECT + INDIRECT, TO-DATE		50,287.48	9,702.52	59,990.00